

ABSTRACT

An optical integrator having characteristics to reduce effects of manufacturing errors of many minute refraction surfaces integrally formed by, for example, etching on an illumination intensity distribution. An optical integrator (8) comprising an integrally formed plurality of first minute refraction surfaces (80a) and an integrally formed plurality of second minute refraction surfaces (80b). A parameter β satisfies conditions, $|\beta| < 0.2$ (where $\beta = (\gamma - 1)^3 \cdot NA^2 / \Delta n^2$), where a refracting power ratio ϕ_a / ϕ_b between ϕ_a , a refracting power of the first minute refraction surfaces and ϕ_b , a refracting power of the second minute refraction surfaces is γ , numerical aperture on an emission side of the optical integrator is NA , and a difference between a refraction index of a medium on a light entrance side of the second minute refraction surfaces and a refraction index of a medium on a light emission side of the second minute refraction surfaces is Δn .